AN ESSAY

ON ARTIFICIAL AND OTHER MANURES,

TO WHICH A

PREMIUM WAS AWARDED

BY

SIR CHARLES LEMON, BART., M.P.,

THROUGH THE

CORNWALL AGRICULTURAL ASSOCIATION,

Read at the Annual Meeting of the Society in December, 1843,

BY W. F. KARKEEK,

TRURO,

Secretary to the Association,

Author of the Prize Essay on Fat and Muscle, to which the Premium of £20 was awarded by the Royal Agricultural Society of England.

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Many of the various artificial manures which have been recommended to the agriculturists within the last few years, having been very extensively used in Cornwall; the Committee of the "Cornwall Agricultural Association" considered that a Report of the results of many of them would prove valuable and interesting, inasmuch as it would not be the opinion or experiments of one individual, however talented and accurate he might be, but the combined experience of a number of persons; and thus the errors and mistakes of one party would be corrected by the experience of others. The better to carry this object into effect, Sir Charles Lemon, one of the members of the Committee, offered a Premium for the purpose; which was awarded to the following Essay, read at the Annual Meeting of the Society in December 1843.

As the experiments narrated, were all conducted by practical farmers, whose names are a sufficient guarantee for their correctness, it is hoped, that the object of the Committee has been fully realized, and as the first fruits of a new line of research, that they may shortly lead to the discovery of more important and general truths.

W. F. K.

In endeavouring to fulfil the desire of Sir Charles Lemon, Bart., made known through the Cornwall Agricultural Association, for "A statement of the result of experiments on the application of chemical and other manures made in this County," it will be expedient to commence with some of the earliest experiments of this kind.

Previous to the year 1835, very few trials of any kind had been made in cultivating the Cornish soil, other than with farm-yard dung, lime, sand, and oarweed, which were the principal fertilizers used by the farmer. About this period, bone dust was introduced by W. Strong and Co., of Exeter, and trials were made with it, at first in a very limited degree; and although success followed in most instances, particularly where it was applied for turnips on our light clay-slate soils, yet it required some time, and a great deal of perseverance and unshaken energy in the introducers of this manure, to induce its general adoption. Its value as a fertilizer is now acknowledged by most farmers, and its introduction into Cornwall may be regarded as one of the most important and successful agricultural efforts in modern days; as it has been, certainly, one great means of increasing the production of sheep, cattle, and corn, and thereby adding to the national resources required for an annually enlarging population.

The first experiments which fell under my notice on the effect of bone dust, were some that were instituted as early as the year 1835, by Mr. Trethewy, of Trewithen, on Carnwinick farm, in Probus, the property of C. H. T. Hawkins, Esq., adjoining Trelyon Common, in St. Stephens parish. At this period it was a barren waste, heath and furze being the only covering of the soil, and had been previously let at two shillings per acre. The estate has a north-west aspect, and lies on a clay-slate soil, of a loamy character.

This first experiment shows in a most striking manner the advantage of bone dust as a fertilizer, and its permanent effect on the land afterwards for eight years. "A field "of several acres was broken from the Common, the "largest portion of which was manured with bone dust, "at the rate of 3 quarters to the acre—the other portion

"of the field was merely dressed with the ashes obtained "from the breaking and burning of the land. The turnip "crop was completely carried off by the fly. In the "years 1836 and 1837 it was cropped with oats, and then "laid down to permanent pasture up to the present time. "There was more than double the quantity of oats on "that portion where the bones had been applied, and at "this period its effect can be plainly distinguished, as if a "line of demarcation had been drawn between rich and "scanty herbage, or between a green meadow and an "uncultivated soil."

The effect of the bone dust in this experiment is extremely satisfactory, inasmuch as it proves that its fertilizing principle is a permanent one; and, in my opinion, completely sets at rest the question which is frequently agitated amongst farmers, as to whether the manuring property of bone exists in the animal matters, which constitute about one-third of its substance, or in the earthy matters, constituting the remaining two-thirds, since it is almost impossible to suppose that any other than the earthy matters could have remained so long in the soil,—the animal matters being probably decomposed in the first and second crops. The second experiment confirms the previous one.

"In 1836, another piece of the 'waste' was broken "which was sown to oats, and on the following year a "similar crop was taken. One portion of the field was "manured with bone dust only. The oats on this part "was equal to the first experiment. After this, the whole "was laid down to pasture, and at the present period, the "line of distinction can be plainly seen where the bones "were applied, at more than four miles distance."

The same beneficial effect is also plainly seen in two large patches, broken in 1837 and 1838. They have been sown with turnips and manured with bone dust only, which produced most excellent crops; after which a crop of oats was taken, and then pastured up to the present period. And in another piece of about six acres, which was broken in 1839, and sown with Swede turnips, an excellent crop was produced; since which, other crops have been taken, and the clover at the present time is very luxuriant, being equal to land let at 40s. per acre.

In 1840, another piece was broken and sown to turnips, with bone as before, and oats in the following year; both crops were excellent. In November, 1841, it was ploughed *once* only, and without any other cultivation sown to turnips in June, 1842. This crop was also good and plainly proved that turnips after grain may be pro-

duced without either spring or summer ploughing. In 1841, another large portion was broken, sown with Swedes and afterwards cropped with oats, using the bone manure only, which answered as well as before.

From the year 1835 to the present period, Mr. Trethewy has thus successfully broken and cultivated patches of waste to the extent of 60 acres. His usual method of cropping is, first, turnips,—then oats,—seeds, and permanent pasture. I witnessed a crop of Swedes there last year, which were decidedly the finest crop grown of the kind in the parish of Probus for the season.

I will next direct your attention to some valuable experiments instituted by Messrs. S. and R. Davey, of Redruth, in enclosing a portion of the "waste" of St. Agnes common; which prove to a demonstration, that most of our barren heath has dormant energies within it, and only requires skill, enterprise, and a small outlay, to bring the whole of these "improvable wastes" into profitable cultivation.

The soil is of an argillaceous character, consisting chiefly of silex, alumina, and a trace of oxide of iron; in many places it has a deep retentive clay subsoil. The farm, called Tywarnhayle, has a south-east aspect, being protected from the sea winds by St. Agnes Beacon and other neighbouring hills. It is almost impossible to find a more barren spot than this part of the common exhibited, previous to its being enclosed; there being scarcely turf enough left to make the hedges, and the greater part being chiefly subsoil. In the following table, you have the method of cropping and manuring which the Messrs. Davey adopted in their first experiment, and the results:—

A. A. R. P. 6 3 12 statute	When sown	Manures per acre.	Produce per acre.	Second sowing.	Manures per acre.	Produce per acre.	Third sowing.	Manures per acre.	Produce per acre.	Seeds and manure.	Present appearance.
Broken in 1839.	Wheat in Autumn.	3 qrs. of Bone. ¼ acre had 30 bus. lime.	Fit only for Pigs & Fowls.	Oats in 1841	Nitrate of Soda 1 cwt.	36 bus. imp. of Oats per acre.	Barley in 1842	Truro town dung, £9 per acre, including carriage, &c.	18 bus. per acre.	Seed. 2 cwt. guano.	Very superior grass.

It will be seen from this experiment, that the soil was not sufficiently powerful to produce a crop of wheat, manured over with bone dust, 3 quarters to the acre. In the oat crop, the following year, manured with 1 cwt. of nitrate of soda, we have 36 bushels of oats and no seeds, in consequence of which the field was tilled to barley in 1842, and dressed with Truro dung (scavengers' dung), at a cost of £9 per acre, including carriage. Here we have another failure, the produce being only 18 imperial bushels per acre. The seeds in the early part of the spring of 1843, made but little progress, in consequence of which it was dressed with 2 cwt. of guano per acre, and its growth shortly after this was surprising. So abundant was the grass during the summer, that it was a wonder to the neighbourhood how so much stock could have been kept for such a length of time. Where the lime had been employed for wheat, the grass was not nearly so thick as on the other parts:—

B. A. R. P. 4 0 2 statute	First crop. When sown.	Manures used per acre.	Produce per acre.	Second crop. When sown.	Manures used per acre.		Produce from guano per acre	Produce from dung and compost.	Seeds.	Manures.	Present appearance.
Broken in 1840.	Wheat in Nov.	Bone dust, 3 quarters.	None.	Oats in 1842	2 cwt. guano.	10 loads compost, dung, earth, &c.	77 bushels white oats.	29 bushels black oats.	1843.	2 cwt. guano.	Very superior.

In this second experiment, it will be seen that the wheat failed as in the first, evidently shewing that wheat was not adapted to the new soil, whilst in the following year we have a beautiful illustration of the effect of guano on a crop of oats, producing 77 bushels per acre. The Messrs. Davey had now learned by experience that the method of cropping and manuring which they commenced with was not such as would be likely to prove successful, and accordingly, in the following experiment, they began cultivating the next piece of "waste" by taking a green crop first, followed by a crop of oats:—

C.	When sown. 1st crop.	Four separate acres manured each with				2nd crop.	Manure per acre.	Produce per acre.	Seeds.	Present appearance
Statute A. R. P. 4 1 0 Broken 1841.	Turnips in June.	Dung 25 load.	Sea weed.	1 ton of horn, &c.	Bone Dust 4 qrs.	Oats in 1842.	2 cwt. of Guano.	72 bush. black oats.	1843, 15 loads farm yard dung.	Very superior.
		Produce.								
		Pasture 15 tons.	none	none	Swedes 18 tons					

In this experiment, the first thing worthy of attention is the trial between bone dust and Truro dung, the result shewing a profit in favour of the bone dust, and a loss of £5. 15s. on the dung; the horn, &c., (being the sweepings of a button and comb manufactory, consisting of filings of bone and horn, and ivory,) and the sea weed, producing no effect whatever. The difference per acre in the expenses in this trial between bone and dung may be estimated as follows:—

DUNG.	£.	s.	d.	BONES.	£.	s.	d.
25 Loads Dung, at 5s...	6	5	0	4 Qrs. Bone, at 23s. ..	4	12	0
Carriage of ditto, at 4s. per load.....	5	0	0	Carriage of ditto.....	0	6	0
Spreading of Dung on the land.....	0	10	0				
	£11	15	0		£4	18	0

Value of Manure.	Produce.	Value per ton.	Value of Produce.	Difference between crop and manure.	Profit and Loss.
			£. s. d.	£. s. d.	
Dung, £11. 15s.	15 tons pasture.	6s.	4 10 0	7 5 0	Loss.
Bone, £4. 18s..	18 tons Swedes.	8s.	7 4 0	2 6 0	Profit.

Again, in the second crop we have as much as 72 bushels *of oats* produced by 2 cwt. of guano per acre. Where the horn and bone sweepings had been used previously for turnips, the oats and seeds were decidedly the better part of the field,—bone next,—dung next, and oar-weed the worst part of the piece. Where the horn had been employed, the land has, at the present time, a far better appearance than any fields in the neighbourhood.

These three fields, A. B. C., kept 30 ewes, 30 lambs, 4 oxen, 3 horses, and 30 pigs, from the commencement of May until the harvest. The grass was cut and carried into the stable for the horses; since which the field has been well stocked with sheep.

The next experiment was on a similar piece of "waste" adjoining the former ones.

D. Statute. A. R. P. 4 0 25	1st crop sown.	Manure per acre.	Produce per acre.	2nd crop sown.	Manure per acre.	Produce per acre.	Seeds.
Broken in 1842.	Swedes in July	4 Qrs. Bone Dust and 1 cwt. Guano.	20 tons Swedes	Barley in 1843.	10 cwt. of hoofs of* animals and 1 cwt. Guano.	12 imperial bushels only.	The clover and the barley was early choked by the rye grass.

The circumstance most worthy of notice here, is the powerful effect produced by the hoofs of animals, in conjunction with guano, on the oats and rye-grass; the latter growing in such an astonishing degree, that it completely choked the clover and very nearly the barley. The field has now the appearance of an old coarse pasture. We also see the effect of guano and bone dust mixed, in an excellent crop of Swedes, 20 tons to the acre.

We have in the following experiment, a similar effect produced by a mixture of bone and guano manures on Swedes, and in the following year another excellent crop of oats with only 2 cwt. of guano per acre:—

E. Statute. A. R. P. 8 2 37	1st crop sown 1842.	Manures per acre.	Produce per acre.	2nd sowing 1843.	Manure per acre.	Produce per acre.	Present Appearance.
Broken from the Common 1842.	Turnips & Swedes sown late.	4 Qrs. Bone, 1 cwt. Guano.	18 Tons.	Oats.	2 cwt. Guano.	60 bush. per acre.	Very Superior.

* Cost at the farm £10 per ton.

Experiments like these carry with them their own reward; they are indeed twice blessed, "they bless him that gives, and him that takes." The greatest of all conquests consists in changing and improving the surface of the earth, so as to secure for the good of man, a proportionate increase of its productive powers; and in warring with sterility, we are changing the solid rock and the naked heath, into green meadows and fertile pastures. The expense incurred in breaking and cultivating an acre of the waste is nearly paid by the two first crops—leaving the value of the straw, about $1\frac{1}{2}$ ton per acre, to pay for incidental expenses.

The expenses incurred by the Messrs. Davey in cultivating an acre of St. Agnes Common, and the value of the produce on the two first crops ONLY may be estimated as follows :—

FIRST CROP.	£.	s.	d.
Ploughing one foot deep first time	1	10	0
Breaking down	0	10	0
Rolling and harrowing	0	10	0
Ploughing, second time	0	15	0
Breaking down, rolling, and harrowing	0	15	0
Tormenting	0	7	6
Rolling and harrowing, second time	0	7	6
Turnip seed, putting in, &c.	0	10	0
$3\frac{1}{4}$ qrs. bone dust, at 23s.	3	16	6
$1\frac{1}{4}$ guano, at 13s.	1	0	0
Enclosing	1	16	0
	£11	17	6
SECOND CROP.			
Ploughing	0	15	0
Tormenting	0	7	6
Seed	0	12	0
Putting in and working down	0	12	0
2 cwt. guano	1	6	0
	£15	10	0

PRODUCE.	£.	s.	d.
20 tons of Swedes, at 8s. per ton	8	0	0
64 bushels of oats, at 2s. per bushel	6	8	0
	£14	8	0

The profit arising from the feeding of stock on the seeds is not considered in this account, but an idea may be formed of their luxuriancy from the circumstance, that during the summer the Messrs. Davey received 7d. per week for the keep of fat sheep belonging to butchers, and at the present period, Christmas 1843, 6d. per week. The

fields are now equal in appearance to others let at 20s. per acre in the same neighbourhood.

It should likewise be mentioned that the expenses incurred in picking and carrying of stones from the different enclosures, was more than repaid, by the sale of the stones for repairing the turnpike roads.

In the experiments which I have related, conducted by Mr. Trethewy and the Messrs. Davey, in bringing into cultivation the "wastes" of our county, we have clear and evident proofs of the efficacy of bone dust and guano.

Sir Charles Lemon, in his notes on the agricultural produce of Cornwall, read before the statistical section of the British Association in 1841, states, on the evidence of Mr. Cowling, given before the Emigration committee in 1827, "that there were improvable waste lands in Cornwall to the extent of 190,000 acres." Since that period, vast quantities of those "wastes" have been brought under the plough, and not a year passes in which the cultivation is not extended. The chief impediment in cultivating those tracks of waste has hitherto been the great expense required in the outlay; but now, by using these manures, it is to be hoped that, ere long, we shall see nearly all the improvable wastes of our county yielding their proportion of food to the inhabitants.

We have also a decided proof of the superiority of bone and guano manures as fertilizers, compared with dung. The two following experiments will also show, in a very satisfactory manner, that in point of cheapness, too, there is no comparison :—

Experiment No. 1.—A trial between bone dust and Truro scavengers' dung, by Mr. George Mason, on Roseveth farm, in Kenwyn, on a crop of white turnips, calculating the price of the dung at 4s. per load—the increased consumption of bone and guano having very materially lessened the use of this article, and consequently its price.

Dung, half-acre.	£.	s.	d.
15 loads of dung from Truro, at 4s. per load.	3	0	0
Expense of carriage 3 miles	1	17	6
Expenses of spreading the dung on the land..	0	15	0
	£5	12	6

Bone, half-acre.	£.	s.	d.
1½ qrs. of bone dust ..	1	14	6
Carriage of ditto	0	1	6
Broad-casting, &c....	0	1	0
	£1	17	0

The crop was equal, being about 20 tons to the acre; but the difference in the expense was so considerable that the farmer could have cultivated *three acres* with bone at

the expense of *one* with Truro town dung. The estate is situated in a poor district, having a south-east aspect, and lies on the clay-slate; valued about 18s. per acre.

Experiment No. 2.—Between dung, bone, and guano, as fertilizers for grass and hay, was instituted on land farmed by the Earl of Falmouth, in the present year, by Mr. Rope, his Lordship's hind, upon a piece of permanent pasture, which had not been ploughed up for fifty years. The field had alternately been mown and grazed during this period, and had received no dressing in the shape of dung, for the last ten years. The soil is of a heavy loam, resting on a clay-slate subsoil, having a northern aspect. THREE HALF-ACRES were carefully selected, measured and manured, on the 24th of March—the hay cut on the 10th of July, and weighed on the 15th. The result will be seen in the following table:—

Manures, per half acre statute.	Cost of manures, including carriage.	Weight of new hay per statute acre.	Value of hay at 30s. per ton	Profit.	Loss.
	£. s. d.	tons. cwts. qrs. lbs.	£. s. d.	£. s. d.	£. s. d.
15 loads of Plymouth dung..	4 8 0	1 8 0 0	2 2 0	. .	2 6 0
10 bus. bone dust	1 12 0	1 2 2 0	1 13 9	0 1 9	
134lbs. of guano	0 17 0	1 12 3 0	2 9 0	1 12 0	

Here we have a decided loss on the part of the Plymouth dung, which consists of the sweepings of Plymouth streets, night-soil, rubbish, &c., of £2. 6s., and a decided gain on the guano of £1. 12s. per half-acre. There cannot be a question after this and the other experiments which I have related, that guano is a most astonishing fertilizer; still this experiment, valuable as it is, is incomplete as it regards the bones, till we see the effect of these manures on the next year's crop, which should be grown without manure, and cut and saved in the same careful manner. The after-grass was very good on each of the pieces, the cattle preferring the part manured with bone.

Mr. Rope tried the guano in various ways. On a piece of ground adjoining, he sowed double the former quantity per acre; and on some young clover also a similar quantity, and the rapid growth of each was extraordinary. The spots where guano was applied could be distinguished at a great distance. In another instance, he dressed half an acre of barley, with which fifteen sorts of grass seeds and three of clover had been sown, and at the present period they are looking remarkably well; there was also

an increase of about eight imperial bushels of barley per acre compared with other parts of the field. I mention this circumstance connected with the seeds, in consequence of its having been stated that guano is injurious to clover and young grasses.

The next experiment to which I would direct your attention was a trial between bone and guano, also made by Mr. Rope, of Tregothnan.

Upon a field of five acres in Swede turnips, which was of a very inferior description, valued at 10s. per acre, a mixture of 15 loads of farm-yard dung, and 5 loads of calcareous sea sand (the coralline deposit found in Falmouth harbour), and 22 loads of soil taken from the ditches, was laid per statute acre—at a cost, including carriage and spreading, &c., of £4. 2s. Three acres dressed in this manner were measured out,—one of them having 2½ cwts. of guano, and another 2½ quarters bone dust extra. The seed was of the purple top variety, and was drilled in at 18 inches distance, on the 15th of June. The difference between the acre which was simply dressed with the dung, sand, and earth, compared with the two acres dressed with bone and guano, was as follows:—

Manures.	Value of Manures per acre.	Weight of crop per acre.	Value of crop per acre at 8s. per ton.	Difference between crop and manures.	
				Profit.	Loss.
Dung, Sand, &c	£. s. d. 4 2 0	7 tons.	£. s. d. 2 16 0	£. s. d.	£. s. d. 1 6 0
Dung, Sand, &c. ..... 2½ cwt. Guano	4 2 0 1 14 0				
	5 16 0	22 tons.	8 16 0	3 0 0	.....
Dung, Sand, &c. ..... 2½ qrs. Bone..	4 2 0 3 0 6				
	7 2 6	25 tons.	10 0 0	2 17 6	.....

In this experiment, the advantage is decidedly in favour of bones, since there cannot be a doubt but that the next crop will derive a much greater benefit from them than from the guano. This experiment is chiefly valuable in proving that had it not been for the outlay in these manures, the crop would never have paid for the dung and sand.

The next experiment was also a trial between bone and guano, giving the advantage to the latter. It was made by

Mr. C. Parks, of Michell. The field was a wheat stubble, manured for that crop with a compost of dung, earth, and sand. When put into turnips, one part was manured with bone dust at the rate of 3 quarters per acre, the other part with guano at the rate of 2½ cwt. per acre. The following calculation was made by selecting an average statute yard of turnips grown with each of these manures, and the result was as follows :—

Manures.	Cost of manures per acre.	Produce per acre.	Value of crop at 8s. per ton.	Difference between crop and manures.
	£. s. d.	Ton. cwt. qr. lb.	£. s. d.	£. s. d.
3 qrs. Bone..	3 12 0	15 4 1 4	6 1 6	2 9 6
2½ cwt Guano.	1 10 0	21 15 2 24	8 14 3	7 4 3

I have made as few remarks as possible on the effect of the different manures which we have passed in review, leaving the experiments to speak for themselves; but in this last one, it must be understood that the land was of a heavy loamy character, which is more suitable to the use of guano than bones.

The next experiment was one between bone dust, Peruvian guano, Potter's artificial guano, and bone dust and Peruvian guano mixed, instituted on a crop of Swedes, on Trelowarren estate, by Mr. Foot, the hind of Sir R. R. Vyvyan, Bart. The land is of a loamy description on a clay-slate subsoil, having a north-west aspect :—

Kinds of manures.	Quantity of manures per acre.	Price of manures per acre.	Weight of turnips per statute acre.	Price at 8s. per ton of crop per statute acre.	Difference between prices of manure & crop.
		£. s. d.	tons. cwts.	£. s. d.	£. s. d.
Bone dust	2½ qrs.	2 12 6	23 8	9 7 3	6 14 9
Peruvian guano...	350 lbs.	2 2 0	25 .	10 0 0	7 18 0
Potter's guano ..	350 lbs.	2 9 0	22 .	8 16 0	6 7 0
Bone dust and Peruvian guano	1½ qrs. 175 lbs.	1 6 3 1 1 0	26 ..	10 8 0	8 0 9

From this experiment we see that the bone dust and guano mixed, gave the heaviest crop, and yielded the largest profit per acre.

Ere I conclude this part of the subject with reference to guano, I should say that it proved itself a most valuable

and cheap manure in Cornwall this last season. For corn crops, such as barley and oats, it was generally sown, either before or after the seed, at the rate of 2 cwt. per acre. For Swedes, it was usually applied from 2 to 3 cwt. per acre. In many instances, where this manure was drilled in with the turnip seed, from not being mixed with a sufficient quantity of earth, wood, or turf ashes, a very large portion of the crop was destroyed. This is occasioned by the large per centage of actual ammonia contained in the Peruvian guano, — for where the guano had been sown broad-cast, the crop was invariably successful, and superior to the drilled turnips. *I should say that in every case where it was drilled in with the seed, not less than a ton of earth or ashes should be mixed with each cwt. of guano, or the guano and ashes might be drilled in the land by itself, and the seed sown broadcast.* The plants would be certain to come up much stronger in the drills, and could be as easily hoed afterwards, as if the seed had been drilled in with the manure. I have heard of some instances of failure from another cause, viz., the impurity of the manure. This is very likely, for there cannot be a doubt that a plenty of inferior stuff will find its way into the market, particularly as, from its very recent introduction, the farmers can scarcely be considered judges of the real from the manufactured.

I will next direct your attention to some artificial manures, which, previous to the introduction of guano, were very commonly employed by farmers as fertilizers for the turnip crop. These are Lance's carbon, Poittevin's, and Clark's composts, and the urate of the London Manure Company.

The following experiment, instituted by J. H. Tremayne, Esq., of Heligan, and carefully conducted by Mr. Reynolds, the hind, in the year 1841, will give a tolerably just view of the powers of these artificial manures.

The field selected for the experiment was a wheaten arish, with a soil not over rich in quality, and not at all qualified to produce an abundant turnip crop, as will be seen in the sequel, having a north-west aspect, and consisting of a heavy loam, resting on a subsoil of a fine-grain argillaceous schist. Having been prepared in the usual manner, four equable acres were selected, which were divided into half acres, and these thrown into ridges, one-half at 18 inches, and the other half at 27 inches distance. The seed was sown by means of a drill, which conveyed the manure along with it, sowing one ridge at a time. The following table will give the different manures used, and their results :—

Manures.	Width of drills.	Quantity per acre.	Cost of manure per acre including freight, &c.	Weight of Turnips per statute acre.	Value of crop at 8s. per ton.	Difference between crop and price of manures.	In favour of 27 inch or 18 inch Drills.
			£ s. d.	tons cwt.	£. s. d.	£. s. d.	
Caff—a mixture of fish refuse and earth mixed	27	20 tons.	2 10 0	9 16	3 18 4	1 8 4	
—2 parts of fish to 20 parts of earth	18	do.	2 10 0	9 11	3 16 4	1 6 4	
				0 5		0 2 0	27 inches
Rich Dung ..	27	20 tons.	4 0 0	12 18	5 3 2	1 3 2	
Ditto	18	do.	4 0 0	13 12	5 8 9	1 8 9	
				0 14		0 5 7	18 inches
Bone Dust ..	27	2½ qrs.	3 0 0	15 1	6 0 5	3 0 5	
Ditto	18	do.	3 0 0	12 0	4 16 0	1 16 0	
				3 1		1 4 5	27 inches
Poittevin's Manure....	27	30 bus.	3 11 0	11 17	4 14 9	1 3 9	
Ditto	18	do.	3 11 0	10 17	4 6 9	0 15 9	
				11 0		0 8 0	27 inches
Ammoniacal Compost ..	27	20 bus.	3 15 0	7 4	2 17 7	0 17 5	Loss.
Ditto	18	do.	3 15 0	8 2	3 4 9	0 10 3	
				0 18		0 7 2	
Lance's Carbon	27	26 bus.	2 14 6	11 4	4 9 7	1 15 1	
Ditto	18	do.	2 14 6	10 9	4 3 7	1 9 1	
				0 15		0 6 0	27 inches
Urate	27	26 cwt.	4 16 0	7 7	2 18 9	1 17 3	Loss.
Ditto	18		4 16 0	10 0	4 0 0	0 16 0	
				2 13		0 1 3	
Clark's Compost	18	26 bus.	3 5 0	11 6	4 10 4	1 5 4	18 inches

It may be necessary to say a few words respecting the composition of some of these artificial manures.

Caff or Calf.

This is a Cornish word used to express decayed fish, which is frequently employed, mixed in the proportion of 1 ton of fish refuse to 10 tons of earth, as a manure for turnips.

Poittevin's Patent Disinfected Manure.

This manure is manufactured by mixing together night soil, mud, carbon, &c., and drying the mass by a very gentle heat.

Ammoniacal Compost.

The horns and hoofs of animals burnt to a powder, and mixed with double their weight of wood ashes.

Lance's Carbon.

This manure is made by mixing the night soil of the metropolis with a quantity of carbon, the whole being dried by a gentle heat.

Urate of the London Manure Company.

Night soil is the basis of this manure, mixed with gypsum.

Clark's Dessicated Compost.

This compost is very similar to Lance's and Poittevin's. The seed was sown on the 8th of June, and the weather at first was very unfavorable. About the 20th of June, the plants from Poittevin's, Lance's, Clark's, the Urate, and Dung, made their appearance, and were in rough leaf on the 28th; the three others lagging two days behind, and when they did rise, having a blue and stagnated appearance. The plants from Poittevin's, Lance's, Clark's, and Dung, were hoed on the 15th of July, not having a distinguishable appearance. The urate and bones were hoed on the 22nd, and the ammoniacal manure and "calf" on the 26th. From this period, the hand and horse hoe were frequently applied. By the latter part of August, the bone had outstripped most of its competitors, which, in the early part of the race, had taken the lead. The "calf" turnips improved a little during October and November, but to the great disappointment of the neighbouring farmers and labourers, who anticipated great results from this compost, they still lagged in the race, as you have seen in the previous table. The result of this experiment, as regards the difference in the weight which the 18 bears to the 27-inch ridges, is rather puzzling, and I leave others to account for it. It was also considered that the land, being of a heavy loamy kind, would be ill-adapted for bone dust, and better adapted to the other manures; but the effect of the bones,

on the whole, in weight and expense, is decidedly in their favour.

Another interesting experiment, which I witnessed, among the many instituted in the year 1841, was the following one, by Mr. Richard Doble, of Barteliver farm, in the parish of Probus, and which, for the correctness and care with which it was conducted, may also be depended on. The field is a free working soil, but not light, on a dun colour slate, worth about 30s. per acre per year, according to land let in this neighbourhood. It inclines towards the south, and is bounded on the west by Trewithen plantations. In this experiment, Lance's carbon took the lead at starting, and for six weeks went considerably a-head, Clark's manure following in the wake; but, after hoeing, the others came quickly on, and, as the result has shown, were decidedly the best crop. I recollect that where the seed had fallen on a spot which was not manured, and there were several left for the purpose of trial, the turnips were not so large as oranges.

Description and quantity of manures per acre.	Cost of manures, freight &c.	Weight of turnips 18 feet square.	Weight of turnips per statute acre.	Value of the crop per acre at 8s. per ton.	Difference between crops & different manures per acre.
1	£, s. d.	lbs.	t. c. q. lbs.	£. s. d.	£. s. d.
Wood and coal ashes 1 qr.....	0 2 0				
Stable dung and earth 20 loads	1 10 0				
Carting and mixing..	0 10 0				
1½ qr. bone dust....	1 16 0				
½ qr. malt screening.	0 5 0				
	£4 3 0	336	24 0 0 0	9 12 0	5 9 0
2					
1½ qr. bone dust....	1 18 0				
Malt screening	0 5 0				
	£2 3 0	281	20 1 1 20	8 0 6	5 17 6
3					
3 qrs. bone dust....	3 12 0	287	20 10 0 0	8 4 0	4 12 0
4					
3 qrs. Lance's carbon	2 8 0	218	15 11 2 2	6 4 6	3 16 6
5					
3 qrs. Clark's compost	2 10 6	240	17 2 3 12	6 17 0	4 6 6

Very considerable quantities of Lance's carbonised manure were used in this county about two and three years

since, and, in justice to this manure, I should state that, in very many instances, it produced a much better crop of turnips than bone dust and at a less expense. On some farms it was used to a very great extent. Mr. Magor, of Coswarth, has successfully used it ever since its introduction, considering it to be a valuable manure for his soil. In many instances, I have seen from 18 to 20 tons, and sometimes as much as 25 tons, of Swedes per acre from the use of 24 bushels.

The following two experiments were with manures of a different description. These were instituted by Sir Charles Lemon, Bart., of Carclew, in 1842 and 1843, as a top dressing for grass land. A portion of the park which had not been broken up for nearly 30 years, was set apart for this purpose, and the *twentieth part of an acre* marked out for each of the kinds of manure which were to be the subject of the experiment. The soil is a yellow loam, averaging from nine inches to a foot in depth; the situation open, but not exposed. The manures were severally applied on the 16th of March; the grass cut on the 25th of July, and the hay carefully weighed on the 27th. No rain fell between the time of cutting and weighing. The following table shews the result:—

Kind of manure.	Quantity used.	Price.	Produce.	
			Grass.	Hay.
		s. d.	c. q. lbs.	c. q. lbs.
1 Nitrate soda & water	11½ lbs. to 50 gal.	2 0	3 3 5	1 3 0
2 „ sown dry.	11½ lbs.	2 0	3 3 1	1 2 15
3 Ammoniacal liquor...	8 gals. in 50 water	0 2	3 2 1	1 1 23
4 Bones mixed with earth at the rate of 8 qrs. to the acre..	1¼ bus. to a load.	1 3	3 2 24	1 1 19
5 Sulphate of soda sown dry	11½ lbs.	1 0	3 3 15	1 2 21
6 „ and water	11½ to 50 gal....	1 0	4 0 16	1 3 9
7 Without manure ..			4 1 24	2 0 0

According to this experiment, the nitrate of soda produced 45 cwt. of hay; bone and earth, 29 cwt.; sulphate of soda, 39 cwt.; whilst, where no manures was applied, we have a produce of 40 cwt. to the acre. This is rather a strange anomaly, as regards the application of manures, and were I not certain that it was correct, I should hesitate in giving publicity to it. But, although there appears to be no benefit derived from the application of those manures to the hay crop, yet I learn from Mr. Booth, who conducted this experiment at Carclew, that where the bones and ammoniacal liquor were applied,

the pasture is decidedly richer and more resorted to by the sheep. The coarse kinds of grass have given place to white clover, and in both instances a fine rich sward has been produced. The plots on which the nitrate and sulphate of soda were applied, had a darker colour than the rest, but it does not appear that there was any increase of hay in consequence. The dose was repeated this year, but without producing any visible difference in the pasture.

Before we arrive at any practical conclusion on this singular anomaly, it would be desirable that the experiment be repeated on another portion of the park, with carefully noted conditions, and I would recommend that two undressed plots at least should be measured out, instead of one, and their relative produce ascertained as before, in order to prevent the possibility of a mistake arising from any difference in the soil, not observable to the eye, which is very likely to have been the case, in this experiment.

The following are the results of a set of experiments made also at Carclew, in 1843, for the purpose of testing the relative merits of certain manures when applied as a top dressing to corn crops. The field selected for giving the whole a fair trial was one with a high open exposure, sloping to the south. The soil is a free light loam, not exceeding a foot in depth, on a yellow clayey subsoil mixed with spar. It had been well manured the previous season, and cropped with turnips. After these were removed, it was prepared and sown with barley in the latter part of April. The manures were applied on the 15th of May. In this case the *tenth part of an acre* was allowed for the experiment.

Kind of Manure.	Quantity used.	Price.	Produce.		Average produce per imperial acre.
			Straw.	Corn.	
		s. d.	lbs.	lbs.	
1 Nitrate of Soda sown dry.....	33½ lbs.	6 4	199	178	48 bushels.
2 Sulphate of Soda	33½	3 0	264	215	45 bus. 6 gal.
3 Guano.....	16½	2 0	280	252	50 do.
4 Sulphate of Ammonia	22½	3 11	269	232	47 do. 4 gal.
5 Stott's soluble manure	12	4 0	288	257	54 bushels.
6 Wash from farm yard.....	100 gal.	..	300	256	52 do. 4 gal.
7 Average of the field.....	....	..	233	200	40 do.

From this table it will be seen, that where the nitrate and sulphate of soda were used, the produce is less than from either of the other applications. From guano we have a large return, considering the small quantity of it used, averaging only 1½ cwt. per acre. The return from sulphate of ammonia is also large. This salt and No. 5 were forwarded to Sir C. Lemon by Mr. G. L. Stott, of Ashley-hill, near Bristol. The sulphate of ammonia is prepared from the refuse of gas works. No. 5 is probably manufactured in the same way, having a very strong smell of ammonia,—one pound to ten gallons of water is the proportion in which it was directed to be used. The return from it was greater than that of any of the others. It appears also from this experiment, that the sulphate of soda (which is the common *Glauber's salt*) proved to be nearly as powerful a fertilizer as the nitrate of soda. This experiment should be tested on other farms, since the sulphate of soda can be manufactured in our country at a very considerably less expense than the nitrate of soda which is obtained from South America, can be purchased for.

I have repeatedly witnessed the effect of the nitrate of soda on different crops. In some instances it produced enormous yields; in other cases no perceptible effect was exhibited. At Mr. Gill's farm, in the parish of Kea, where it was employed on seeds at 1½ cwt. per acre, it produced about 1 ton of hay per acre more than on the other parts of the field. At Mr. Pearce's farm, proprietor of the Hotel, Truro, the nitrate was used to a very considerable extent, (about £50 worth this last season), at the rate of 2½ cwt. per acre. Mr. Pearce calculates that it afforded him the same quantity of hay per acre as he usually obtained from a dressing of 30 loads of dung and earth mixed.

The following experiment, made by Mr. Richard Doble of Probus, also shews that the nitrate had a very beneficial effect on the wheat crop. On the 20th of April, he sowed 70 lbs. weight of nitrate of soda on half an acre of wheat; in about a fortnight, the effect of the nitrate could be perceived as far off as the field could be seen; the wheat grew considerably stronger and thicker on that part, and at harvest, the straw was full six inches higher. Mr. Doble carefully cut half an acre of wheat adjoining for comparison, and the result was as follows :—

Nitrated Wheat.	£.	s.	d.
60 Sheaves 1,456 lbs. at 3d. each	1	6	0
Straw 1,192 lbs.	0	10	6
19 bushels 1 gallon best wheat, at 7s. 4d. per bushel	6	14	9
7 gallons seconds			
	8	11	3
	6	10	9
Difference	£2	0	6
Deduct value of Nitrate 70 lbs. at £1. 1s. per cwt., the present price.	0	13	1½
Profit	£1	7	4½

Non-Nitrated.	£.	s.	d.
36 Sheaves 857 lbs.	0	15	0
Straw 940 lbs.	0	8	6
14 bushels 1 gallon best wheat, at 7s. 4d.	5	7	3
7 gallons seconds			
	£6	10	9

Nitrate of soda has chiefly been used as a top dressing for corn and grass crops. When it was first introduced, an experiment was made in a small way on Tregeagle and Golden estates, in Probus, for Swedes, in 1841, with this salt, mixing it with wood and turf ashes, and drilling it in with the seed at 1½ cwt. per acre, and it had no perceivable effect; whilst on Enys farm, the seat of J. S. Enys, Esq., where it was used in the same proportions, and from the same parcel, for turnips, it produced as good a crop as either bone or dung.

Mr. Gill, of Menadews, also used this manure for turnips, at two cwt. per acre, sown broad-cast, and the crop was a fair one, but not equal to turnips growing in the same field manured with bone, at the same cost per acre.

Mr. George Mason, last March, tried nitrate of soda against guano, as a top-dressing for wheat. The land was prepared in the usual manner with dung, sand, and earth, using about 20 loads of dung per acre. One-half was dressed with guano, at 2½ cwt. per acre, and the other half with the nitrate at 2 cwt. per acre. At the harvesting, he could not distinguish any difference either in the weight of straw or seed. The crop was an excellent one, being 54 bushels per acre, and this, too, on a piece of land taken but one year previously from the Four Burrow Common.

From these experiments, made with the nitrate of soda, we learn that cases have occurred where it has failed to produce any apparent effect; and others where it has proved highly beneficial. Both the failure and the amount of benefit derived from its use are deserving attention, and it is probable that unless we have an accurate analysis of the different soils whereon it has been tried, we shall not

be able to form any correct opinion as to the causes which appear to influence its success in one case, or failure in another. To some, an explanation may appear to be easily given, by supposing the one soil to be rich in soda, whilst the other was deficient in this substance; yet, in the case of the experiment tried by Mr. Pearce, it proved highly useful and profitable, and it is scarcely possible to suppose that land such as his, manured, as it has been, with stable dung in immense quantities for more than 30 years, was not exceedingly rich in nitrogenised substances, as well as in the salts of potash and soda.

Daniel's patent manure.—This appears to be another of those capricious manures which answer only on certain soils. The proprietor of this substance should be in a situation to inform the public the particular soils in which it will be certain to prove beneficial, since, where it has been tried in this neighbourhood, it has proved injurious rather than otherwise. Mr. Tilly, of Tremough, tried it in various ways, but always with unfortunate results. Other instances, also, have come to my notice where it has been tried, but with the same ill-luck.

Gypsum, or sulphate of lime, is another of those questionable manures which appear to answer on some soils, particularly in the growth of clover and the grasses, whilst on our clay-slate soils it has no visible effect whatever, as far as I am aware of. It has been stated, that occasional failures may be attributed to the soil already possessing those earthy salts in an eminent degree, but this is not the case here, since our killas soil, in a natural state, scarcely contains any lime whatever. The following table will give the reader a just idea of the chemical composition of the slate soils in Cornwall, obtained by Professor Phillips, of the Museum of Economic Geology:—

	Red Clay Illogan Downs.	Yellow Clay Illogan Downs.	Clay from Nancekuke Downs.
Silica	69 0	61 2	60 4
Allumina.....	23 0	28 8	27 4
Oxide of Iron....	8 0	10 0	12 2
	100 0	100 0	100 0

In some other analyses which I have seen of the "wastes" of our county—particularly one taken by Professor Phillips, for Sir Charles Lemon, Bart., there are nearly the same chemical proportions, having only what

the chemists call a trace of sulphate of lime, so that its failure cannot possibly be attributed to a superabundance already existing in the soil.

CONCLUSION.

In crossing the county of Cornwall, in almost every direction, there are evident proofs of what the "wastes" might be made capable of yielding, from the numerous small enclosures which, here and there, have been brought into cultivation from neighbouring Commons. I have recorded two instances only in the essay, which may well stimulate the proprietors of these "wastes" to immediate exertion, by which a very considerable number of acres might speedily be made capable of yielding a proportionate amount of food to the inhabitants, a remunerating profit to the farmer, and a good per centage on the outlay invested in the improvement.

In addition to this, I have related several instances to shew where large returns have been made from a moderate outlay in bone, guano, and other manures, as well as several instances of failure—all of which will serve as a beacon to warn the experimentalist from striking on similar rocks.

The farmer will also see from the manner in which many of the experiments have been conducted, that in order to obtain a legitimate and correct account of the result of any which he may institute, whether for his own private satisfaction, or for the benefit of the public generally, in each case he must become a laborious and diligent collector of facts—weighing and measuring everything as he proceeds; and in every experiment there should be one or two plots of each field left unmanured, in order to obtain a fair average of the unaided fertility of the land, since, by the application of expensive manure it is an easy matter to obtain large crops; but the object of cultivation is to obtain a remunerating profit for the outlay; and there can be no doubt that the more scientifically the farmer proceeds, the more effectually will this object be gained.

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